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Temperamental Anger and Positive Reactivity and the Development of Social Skills: Implications for Academic Competence during Preadolescence

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Abstract

Research Findings—This study examines whether the development of social skills during childhood serves as a mechanism through which temperamental anger and positive reactivity in toddlerhood influences children’s academic competence during preadolescence (N = 406). Temperamental anger at age 2 was negatively associated with children’s social skills at age 7; in turn, children’s social skills at age 7 were negatively associated with teacher report of academic competence and child and teacher report of school problems at age 10. All three indirect effects were significant suggesting that children’s social skills at age 7 is one mechanism through which temperamental anger at age 2 is associated with age 10 child- and teacher-reported school problems. Temperamental positive reactivity was not associated with children’s social skills or academic competence.

Practice or Policy—Results provide support for early entry points to teach toddlers, especially those high in anger reactivity, the skills to engage in socially appropriate interactions with classmates and teachers, which may lessen subsequent academic challenges.

Keywords

temperament; anger; positivity; social skills; academic competence

Children’s academic competence is an important predictor of future well-being and success within social, personal, and academic realms (Caspi, Elder, & Bern, 1987; Duncan et al., 2007; Ensminger & Slusarcick, 1992). Research from various disciplines has sought to identify early factors, such as sociocultural, family, school, and child characteristics, that explain why some children have difficulty succeeding academically, whereas others thrive. Recently, there has been growth in empirical and theoretical work considering children’s temperamental traits as important factors in pathways toward academic success (e.g., Blair, 2002; Eisenberg, Spinrad, & Eggum, 2010; Valiente, Lemery-Chalfant, Swanson, & Reiser,

2008). Relatively little research, however, has considered whether and how children's temperamental emotional reactivity influences later academic competence. Temperamental anger and positive reactivity, in particular, may play a salient role in pathways towards academic adjustment.

Although there are likely multiple pathways toward academic success for children with varying levels of temperamental anger and positive reactivity, we hypothesize that children's development of appropriate social skills is one mechanism through which this association occurs. Specifically, children who experience intense anger may have difficulty developing appropriate social skills because they become too emotionally aroused to gain accurate information from their social environment or because they have fewer peer interactions due to being rejected (e.g., Pope & Bierman, 1999; Rydell, Thorell, & Bohlin, 2007). In turn, poor social skills may hinder the development of supportive peer relationships and dampen children's enthusiasm for school in general, thereby negatively impacting children's academic competencies. On the other hand, expressions of positive emotion may facilitate the initiation and regulation of social exchanges with peers (Denham, McKinley, Couchoud, & Holt, 1990; Dougherty, 2006), thereby providing more opportunities to develop appropriate social skills and promoting positive adjustment at school (Pekrun, Goetz, Titz, & Perry, 2002). In the current study, we test whether the development of social skills during childhood is a mechanism through which children's temperamental anger and positive reactivity in toddlerhood influences academic competence during preadolescence.

Temperament and Academic Competence

Temperament, defined as early emerging, relatively stable individual differences in the realms of affectivity, activity level, attention, and self-regulation (Shiner et al., 2012; Stifter & Dollar, 2016), has emerged as an important factor in children's pathways toward academic competence (e.g., Eisenberg et al., 2010; Valiente et al., 2008). Children's temperamental traits may influence their reactions to the school environment, their ability to adhere to the rules and expectations within the classroom, and the quality of their interpersonal relationships with both teachers and peers (Blair, 2002; Keogh, 2003; Valiente et al., 2008). Thus, investigating the specific role of these early traits in pathways toward success in the academic environment is important. A significant body of research has emerged highlighting that temperamental effortful control, often discussed as the regulatory, rather than reactivity, component of temperament (Rothbart & Bates, 2006), is associated with children's adaptive academic adjustment, including classroom participation, quality of relationships with teachers, and fewer externalizing behaviors (Graziano, Reavis, Keane, & Calkins, 2007; Kim, Nordling, Yoon, Boldt, & Kochanska, 2013; Valiente et al., 2008). More recently, empirical work has considered aspects of temperamental emotional reactivity, especially negative emotional reactivity which encompasses the emotions of anger, fear, anticipatory anxiety, sadness, guilt and discomfort (Rothbart & Bates, 2006), as impacting children's academic competence (Pekrun, 2006; Raver, 2002; Raver, Garner, & Smith-Donald, 2007). It has been suggested, however, that the specific components of negative emotional reactivity (i.e., anger, fear, sadness) may each play specific roles in children's developmental trajectories and thus should be considered separately (Stifter & Dollar, 2016).

We propose that individual differences in children's temperamental anger reactivity are particularly important to consider. Anger reactivity, which often stems from one's goals being blocked or interrupted (Rothbart, Ahadi, & Hershey, 1994), is associated with a range of maladaptive developmental outcomes, including externalizing behavior problems and low social competence (Rothbart & Bates, 2006; Stifter & Dollar, 2016). Although anger reactivity can serve an adaptive purpose by motivating goal-oriented behavior (Saarni, Mumme, & Campos, 1998), inappropriate intensities or expressions of anger may generate aggressive or socially-unsuitable behaviors that negatively influence peer interactions and prevent socially adaptive problem-solving skills (Pope & Bierman, 1999). Further, anger may negatively influence the effort children put into their schoolwork, how much motivation they have toward completing academic projects, and how much they enjoy the school environment (Pekrun, 2006; Pekrun, Elliot, & Maier, 2009). For instance, children who experience intense anger when they don't perform well on a task or when dealing with a challenging academic assignment, likely have greater difficulties staying engaged or on-task. Moreover, anger-prone children may behave aggressively with peers or teachers and therefore have lowered social supports in the classroom making school even more challenging and unenjoyable. Indeed, teachers' reports of children's anger were negatively associated with engagement in kindergarten (Valiente, Swanson, & Lemery-Chalfant, 2012) and teachers', but not parents', reports of Chinese students' anger were associated with lowered GPA (Zhou, Main, & Wang, 2010).

Although there has been some support for the association between negative emotional reactivity and academic functioning, there is a lack of empirical work considering the role of children's positive reactivity in relation to academic competence. In contrast to anger, positive reactivity, characterized by children's inclination toward experiencing and expressing positive emotions, may relate to positive school adjustment (Pekrun, Goetz, Titz, & Perry, 2002), such as greater academic engagement (Pekrun & Linnenbrink-Garcia, 2012; Reschly, Huebner, Appleton, & Antaramian, 2008). Although not empirically tested with children, it has been suggested that positive emotions may enhance motivation, direct attention toward task performance, and facilitate information processing (Pekrun & Linnenbrink-Garcia, 2012). Moreover, inclinations toward positive reactivity may help children in the development of social relationships, both with teachers and peers (Denham, 1998), as well as increase school engagement (Valiente et al., 2012). However, there is also empirical work that fails to find positive reactivity as a significant predictor of academic competence (Denham et al., 2012; Diaz et al., 2017; Herndon, Bailey, Shewark, Denham, & Bassett, 2013; Lewis, Huebner, Reschly, & Valois, 2009). Given the lack of empirical inquiry regarding this association, research is needed to better understand the role of early inclinations toward positive emotions in later academic competence.

Children's Social Skills as a Potential Mechanism

There has been little empirical work considering the mechanisms that explain the process by which children prone to experiencing anger/positive reactivity develop academic competence, or a lack thereof (for an exception with Chinese children see Zhou et al., 2010). Although there are likely multiple pathways toward academic success for children with varying levels of temperamental anger and positive reactivity, we hypothesize that children's

development of appropriate social skills is one important potential mechanism through which this association occurs.

Specifically, children's anger and positive reactivity likely impact opportunities for children to socially thrive. For instance, it would be expected that children who show quick and intense displays of anger around peers may be at a disadvantage in social contexts because they are likely rejected by their peers (Pope & Bierman, 1991) and thus, have fewer opportunities to interact with peers and learn and practice important social skills. There is a rich history of empirical work highlighting that anger-prone children are at a greater risk of social maladjustment, such as lowered social skills, qualities of their peer relationships, and popularity (Dougherty, 2006; Eisenberg et al., 1993; Ladd, Birch, & Buhs, 1999; Pianta, Cox, & Snow, 2007; Rydell et al., 2007). This association continues into the school environment where anger-prone children may face more challenges developing and maintaining relationships in the classroom (Dougherty, 2006; Ladd & Burgess, 2001; Pianta et al., 2007). Thus, social difficulties may create a stressful school environment that makes academic tasks more challenging (Pianta & Stuhlman, 2004; Spilt, Hughes, Wu, & Kwok, 2012).

On the other hand, positive reactivity can facilitate the initiation and regulation of social exchanges with peers (Denham et al., 1990; Dougherty, 2006), which may promote more opportunities to learn appropriate social skills. There is some empirical evidence showing that children prone to experiencing positive emotions are more socially competent, as illustrated by higher peer ratings and prosocial behavior (Parlade, Messinger, Delgado, Kaiser, Van Hecke, & Mundy, 2009; Schultz, Izard, Stapleton, Buckingham-Howes, & Bear, 2009). Children who are accepted by their peers may be more likely to experience and learn from classroom activities that promote learning and exposure to educational materials (Wentzel, Parke, & Widaman, 2009). These children may also like school better and therefore, are more motivated to engage in classroom learning (Buhs, Ladd, & Herald, 2006). It is also possible that socially skilled children are more likely to request and receive assistance from peers and teachers on challenging academic tasks. Thus, it may be that more positive children will display more appropriate social skills in the school environment, which in turn will promote their academic competence.

Indeed, there is a vast history of research highlighting the importance of social competence as an indicator of adjustment across a variety of realms (Hubbard & Coie, 1994; Ladd, 1999; Rubin, Bukowki, & Parker, 2006), including academic competence (e.g., Wentzel et al., 2009). To date, most research considering the role of social abilities in relation to academic competence has focused on the broad construct of social competence. Importantly though, there are multiple aspects of social competence, including social skills, peer status/acceptance, and friendship quality, and examination of the specific aspects of social competence may aid in understanding the specificity of this association across development.

Social skills are thought to be the first aspect of social competence to develop (e.g., Robinson, Zahn-Waxler, & Emde, 1994), and increase in frequency and sophistication with school entry (Eisenberg, Fabes, & Spinrad, 2006). Examples of socially skilled behaviors include the ability to respond in an appropriate manner to situations that are both high and

low in conflict, sharing and cooperating, appropriately asserting oneself, and helping others (Gresham & Elliot, 1990; Rose-Krasnor & Denham, 2009). Thus, an inability to behave in a socially acceptable and skilled manner, in particular, could have long-term academic implications. Children who learn appropriate social skills, and therefore are better able to navigate through social situations in school, are more likely to start off the school experience on better footing and continue to benefit from these social skills and experiences as they progress through the elementary school years. Thus, these children likely develop better social relationships that provide emotional and social resources, and in turn, may perform at a higher level in the academic environment.

The Current Study

The existing literature highlights the need for empirical work to consider the role of temperamental anger and positive reactivity in pathways towards children's academic competence, as well as a potential mechanism, children's social skills, that underlies this association. Specifically, children with high levels of anger may have difficulty developing appropriate social skills and thus may encounter more social challenges in the school context; in turn, lower social skills may negatively impact children's academic competencies. On the other hand, children prone to experiencing positive reactivity may be more likely to develop social skills and thus do better in the academic environment. We chose to measure children's social skills in middle childhood because it is a period of significant social transitions when children enter the formal school environment, become more active members of social groups, and establish friendships. We hypothesize that an inability to behave in a socially appropriate and skilled manner by this point in early development could have long-term academic implications.

The first aim of the study was to assess whether toddlers' temperamental anger and positive reactivity are associated with children's social skills in childhood. A second aim of the study was to assess whether children's social skills in early childhood predicted academic competence in preadolescence, as rated by both children and their teachers. The third aim of this study was to examine whether the development of appropriate social skills during early childhood is a mechanism through which temperamental anger and positive reactivity in toddlerhood influences children's academic competence during preadolescence. We hypothesized that toddler anger reactivity at age 2 would be associated with lower social skills at age 7, and in turn, lower social skills at age 7 would be associated with both teacher and child report of lowered academic competence at age 10. We also hypothesized that toddler positive reactivity would be associated with increased social skills at age 7, and in turn, greater social skills at age 7 would be associated with teacher and child report of academic competence at age 10.

Method

Participants

This study utilized data from three cohorts of children who are part of an ongoing longitudinal study of social and emotional development. The goal for recruitment was to obtain a sample of children who were at risk for developing future externalizing behavior

problems, and who were representative of the surrounding community in terms of race and socioeconomic status (SES). All cohorts were recruited through child day care centers, the County Health Department, and the local Women, Infants, and Children (WIC) program. Potential participants for cohorts 1 and 2 were recruited at 2-years of age (cohort 1: 1994–1996 and cohort 2: 2000–2001) and screened using the Child Behavior Checklist (CBCL 2–3; Achenbach, 1992), completed by the mother, in order to over-sample for externalizing behavior problems. Children were identified as being at risk for future externalizing behaviors if they received an externalizing T-score of 60 or above. Efforts were made to obtain approximately equal numbers of boys and girls. This recruitment effort resulted in a total of 307 children. Cohort 3 was initially recruited when infants were 6 months of age (in 1998) for their level of frustration, based on laboratory observation and parent report, and were followed through the toddler period (see Calkins, Dedmon, Gill, Lomax, & Johnson, 2002, for more information). Children from Cohort 3 whose mothers completed the CBCL at two-years of age ($N = 140$) were then included in the larger study. Of the entire sample ($N = 447$), 37% of children were identified as being at risk for future externalizing problems at age 2. There were no significant demographic differences between cohorts with regard to gender, $\chi^2(2, N = 447) = .63, p = .73$, race, $\chi^2(2, N = 447) = 1.13, p = .57$, or two-year SES, $F(2, 444) = .53, p = .59$.

Of the 447 originally selected participants, six were dropped because they did not participate in any data collection at 2 years old. An additional 12 families participated at recruitment, did not participate at two-year, but did participate at later years. Finally, 4 participants were dropped due to developmental delay, resulting in 425 participants total at the 2-year assessment. At age 7, 350 families participated. There were no significant differences between families who did and did not participate in terms of gender, $\chi^2(1, N = 447) = 2.12, p = .15$, race, $\chi^2(3, N = 447) = .19, p = .67$, and two-year externalizing T score, $t(445) = 1.30, p = .19$. Families with lower 2-year SES, $t(432) = -2.61, p < .01$, were less likely to participate in the 7-year assessment. At age 10, 357 families participated. No significant differences were noted between families who did and did not participate in the 10-year assessment in terms of child gender, $\chi^2(1, N = 447) = 3.31, p = .07$; race, $\chi^2(3, N = 447) = 3.12, p = .08$; 2-year SES, $t(432) = .02, p = .98$; or 2-year externalizing T score, $t(445) = -.11, p = .91$.

The sample for the current study included 406 children (53% girls, 47% boys) who had available data at the 2-, 7-, or 10-year assessment; 67% of the sample was European American, 27% African American, 4% biracial, and 2% identified as “other.” Families were economically diverse based on Hollingshead (1975) scores at the 2-year assessment, with a range from 14 to 66 ($M = 39.49, SD = 11.13$), thus representing families from each level of social strata typically captured by this scale. Hollingshead scores that range from 40 to 54 reflect minor professional and technical occupations considered to be representative of middle class.

Procedures

Children and their mothers participated in an ongoing longitudinal study beginning at age 2. When children were 2 years old, they came to the laboratory with their mothers and as part

of that visit mothers reported on their child's temperamental traits. When children were 7 years old, teachers reported on the children's social and psychological functioning. At 10 years of age, both teachers and children reported on children's academic productivity and school problems. Only the measures relevant to the current study are reported here.

Measures

Temperamental anger and positive reactivity—Temperamental anger and positive reactivity were assessed through maternal report on the Toddler Behavior Assessment Questionnaire (TBAQ; Goldsmith, 1996). This widely-used measure includes 108 items used to assess maternal report of toddlers' temperament-related behavior at 2 years of age. Items were rated on a 7-point scale (1 = *never* to 7 = *always*). The measure includes five subscales that assess activity level, anger, fear, pleasure, and interest/persistence. Most internal consistency measures exceeded .80 for each scale in the initial measure validation (Goldsmith, 1996). In addition, Goldsmith (1996) documented interrater reliability of the instrument and convergence with other temperament measures. The anger subscale (28 items; $\alpha = .92$) and pleasure subscale (19 items; $\alpha = .83$) were utilized in the current study as measures of toddler's anger and positive reactivity.

Social skills—Children's social skills were measured through teachers' report on the elementary version of the Social Skills Rating System (SSRS-T; Gresham & Elliott, 1990). This measure assesses teachers' perceptions of children's skills and abilities by having teachers rate how often certain behaviors occur (0 = *never* to 2 = *very often*) or where students' behaviors fall in relation to their classmates (1 = *lowest 10%* to 5 = *highest 10%*). The measure includes items such as "invites others to join in activities" and "receives criticism well." This measure includes the subscales of social skills, problem behavior, and academic competence. The SSRS-T is considered a reliable and valid measure of children's social skills, problem behaviors, and academic competence (Demaray, Ruffalo, Carlson, & Busse, 1995; DiPerna & Elliott, 1999). Criterion-related validity for the teacher form has been shown using the Social Behavior Assessment (SBA; Stephens, 1978), the Child Behavior Checklist-Teacher Report Form (CBCL-TRF; Achenbach & Edelbrock, 1983) and the Harter Teacher Rating Scale (TRS; Harter, 1985). The social skills scale (40 items; $\alpha = .82$) is comprised of a mean composite of the assertion, cooperation, responsibility, and self-control subscales and is used as the measure of children's social skills in the current study.

School Problems—At 10 years of age, children and their 5th grade teachers completed the Behavioral Assessment Scale for Children-2 (BASC-2; Reynolds & Kamphaus, 2004). Children completed the Self-Report of Personality (SRP) child version (8–11) of the BASC-2 (Reynolds & Kamphaus, 2004). This measure includes 139 items assessing children's behavior, emotions, and personality. There are true/false questions and scale items rated on a 4-point scale (0 = *never* to 3 = *almost always*). Teachers completed the Teacher Rating Scale (TRS) child version 6–11 of the BASC-2 (Reynolds & Kamphaus, 2004). The TRS includes 139 items that assesses adaptive and maladaptive behavior children exhibit in the school setting. Each question uses the same scale (0 = *never* to 3 = *almost always*). Both versions of the BASC-2 assess children's behavioral, psychological, and school functioning. For the current study, we utilized the school problems sum indices of combined sex t-scores

for both the child- (14 items; $\alpha = .89$) and teacher-report (15 items; $\alpha = .93$). The school problems index is composed of the attention problems (i.e., how well or not well a child is able to listen and pay attention to important stimuli and how well they can sustain their attention) and learning problems (i.e., how well a child is functioning in school with class assignments and overall comprehension of the material) subscales. The school problems t-score on both versions of the BASC-2 show high external reliabilities and validities (Reynolds & Kamphaus, 2004). Of note, although a portion of this sample of children were oversampled for externalizing behavior problems at age 2, by age 10, the sample represented a relatively normative sample of children. For instance, at age 10, approximately 7% of the sample reported clinical levels of school problems.

Academic Competence—Academic Competence was assessed by teacher report of children's behaviors when they were 10 years old on the SSRS-T (Gresham & Elliott, 1990). As part of this measure, teachers were asked to report where students' behaviors fall in relation to their classmates (1 = *lowest 10%* to 5 = *highest 10%*) regarding a range of academic-related behaviors (i.e., "compared with other children in my classroom, the overall academic performance of this child is...", "this child's overall motivation to succeed academically is...", "compared with other children in my classroom this child's intellectual functioning is..."). The academic competence scale is comprised of 9 items and had adequate reliability ($\alpha = .89$).

Results

Descriptive statistics and correlations for primary study variables are presented in Table 1. As expected, temperamental anger at age 2 was correlated negatively with children's social skills at age 7; age 7 social skills were positively correlated with academic competence and negatively associated with school problems (both child- and teacher-report) at age 10. Against expectations, temperamental positive reactivity was not significantly associated with social skills or academic competence. Child-reported and teacher-reported outcome variables at age 10 were significantly associated with one another. A path analysis was completed to examine the associations between children's temperamental anger and positive reactivity in toddlerhood, children's social skills in childhood, and their academic competence in preadolescence. Mplus (Version 7; Muthén & Muthén, 2012) was used to conduct the analyses and Full Information Maximum Likelihood (FIML) was used to handle missing data. Given that child sex was correlated with temperamental anger, children's social skills, and academic competence, and that race was correlated with temperamental anger, child sex and race were included as covariates in the model.

Evaluation of model fit was assessed by examining the comparative fit index (CFI) (Marsh & Hau, 2007), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA) (Cole & Maxwell, 2003). Values close to or greater than .95 indicate good model fit for the CFI, values less than .06 indicate good model fit for RMSEA, and values less than or equal to .08 indicate good model fit for SRMR (Hu & Bentler, 1999). Based on these criteria, the hypothesized model was an excellent fit to the data, $\chi^2 (27, N = 406) = 408.73, p = .00, CFI = .99, SRMR = .03, RMSEA = .02 [CI = .01, .07]$ (standardized coefficients are presented in Figure 1).

Results indicated that temperamental anger at age 2 was positively associated with teacher-reported school problems and negatively associated with teacher-reported academic competence (for standardized estimates see Figure 1). In addition, temperamental anger at age 2 was associated negatively with teachers' report of social skills at age 7 (see Figure 1), suggesting that toddlers who were more anger-prone were less likely to have developed appropriate social skills by the early elementary school years. Temperamental positive reactivity at age 2 was not significantly associated with either age 7 social skills or age 10 academic competence variables. We also assessed whether children's social skills during childhood predicted both teacher and child report of academic competence in preadolescence. Results indicated that children's social skills at age 7 were associated negatively with child- and teacher-reported school problems, and were associated positively with teacher-reported academic competence at age 10 (see Figure 1). These findings suggest that children with greater social skills in childhood were less likely to have self- or teacher-reported problems in school. Further, children with greater social skills were more likely to be rated by their teachers as being academically competent by being rated as performing at a high level academically and intellectually, being motivated, and behaving appropriately in the classroom.

The final aim of this study was to examine if the development of appropriate social skills during childhood is a mechanism through which temperamental anger and positive reactivity in toddlerhood influences children's academic competence during preadolescence. We used a bias-corrected bootstrapping procedure (10,000 draws), to test the indirect effect of temperamental anger/positive reactivity in toddlerhood on academic competence and school problems in preadolescence, through children's social skills. This approach has been shown to generate the most accurate confidence intervals for indirect effects, reducing Type 1 error rates and increasing power over other similar tests (MacKinnon, Lockwood, & Williams, 2004). The indirect effect from temperamental anger at age 2 to each of the age 10 outcome variables was significant via children's social skills at age 7 (see Table 2 for unstandardized estimates of indirect effects). These findings indicate that temperamental anger in toddlerhood was associated with teacher- and child-reported school problems and teacher-reported academic competence in preadolescence through its association with children's ability to behave in a socially skilled manner in childhood. The indirect effect from temperamental positive reactivity at age 2 to each of the age 10 outcome variables was non-significant via children's social skills at age 7.

Discussion

Extensive theoretical and empirical work has sought to identify early factors that explain variations in children's pathways towards academic success. Children's early temperamental traits have emerged as important child characteristics that may explain why some children are highly successful in the academic environment, while others have greater difficulty. Although there has been a growth in empirical work considering whether and how temperamental negative emotional reactivity influences pathways toward academic competence, there is evidence that specific negative emotions (i.e., anger, fear, sadness) play distinct roles in children's developmental trajectories (Stifter & Dollar, 2016); we hypothesized that anger, in particular, is an important negative emotion to consider in this

association. Moreover, there is a lack of empirical work examining the role of children's positive reactivity in later academic competence and the limited findings are mixed (e.g., Diaz et al., 2017; Linnenbrink, 2007), thus warranting additional empirical investigation.

The specific mechanisms that underlie the association between children's early anger and positive reactivity and later academic adjustment are also largely unclear. We hypothesized that children's development of social skills is one mechanism through which these associations occur. For instance, children with high levels of anger may have trouble developing appropriate social skills and therefore have greater difficulty interacting with peers and building positive and supportive relationships; thus, lowered social skills may negatively impact children's subsequent academic competencies. Children prone to experiencing positive emotions may be more likely to develop appropriate social skills which, in turn, may facilitate academic competence. To fill these gaps in the literature, the current study examined the development of social skills during childhood as a mechanism through which temperamental anger and positive reactivity in toddlerhood influence children's academic competence during preadolescence.

As hypothesized, children who were rated as high in anger reactivity in toddlerhood by their mothers were rated to have greater school problems and lower academic competence by themselves and their 5th grade teachers. Although there is a vast literature showing that anger-prone children are more likely to develop social and psychological difficulties, this is one of few existing studies showing that children high in anger reactivity in toddlerhood are more likely to struggle academically in preadolescence. This association is not surprising given that children's efforts to meet the challenging academic and social demands that arise in the school environment can elicit anger; thus, children who experience that anger to a higher degree may have a more difficult time meeting those demands. Because this study spans an 8-year period from toddlerhood to preadolescence, and much of the existing research focuses on the preschool and elementary school periods, this work extends the current literature and demonstrates that early temperamental anger reactivity can influence children's academic competence into the late elementary school period.

Anger-prone children who cannot appropriately manage their anger and associated aggressive behaviour are less likely to stay on task and focus attention on learning, both of which are needed for continued academic achievement (Breslau, Breslau, Miller, & Raykov, 2011; Moilanen, Shaw, & Maxwell, 2010; Neuenschwander, Rothlisberger, Cimeli, & Roebbers, 2012). Moreover, anger-prone children are more likely to engage in aggressive behaviors that may hinder children's ability to behave appropriately in the classroom, attend to academic challenges, and build social relationships with peers and teachers. The findings from the current study highlight how early and stable the pathway toward academic maladjustment can become established for children high in temperamental anger reactivity. Interestingly, a direct association was not revealed for child-reported school problems in the 5th grade. It is unclear why this would be the case; however, it is possible that children consistently high in anger reactivity are less likely to be aware of or self-report the difficulties that they are having in the school environment.

Counter to our expectations, results from this study showed a null association between positive reactivity at age 2 and children's social skills at age 7 and academic competence at age 10. This adds to a growing literature of mixed findings regarding the association between positive reactivity and aspects of academic competence. For instance, some studies report that positivity is associated with academic skills (Sirotkin, Denham, Bassett, & Zinsser, 2013) and academic functioning (Hernández et al., 2016), whereas the associations between positive reactivity to academic competence are not always present (Denham et al., 2012; Herndon et al., 2013; Lewis et al., 2009).

It is also surprising that there was not a significant association between age 2 positive reactivity and age 7 social skills (Sallquist, DiDonato, Hanish, Martin, & Fabes, 2012; Spinrad et al., 2004). However, there are multiple factors that may explain the lack of association between positive reactivity and social skills/academic competence in this study and should be considered in future research. First, it is likely that the type and intensity of positive emotion, as well as the reporter of and context of the expressed emotion, influence the nature of the association between positive reactivity and a range of developmental outcomes (e.g., Putnam, 2012; Stifter & Dollar, 2016). Indeed, the heterogeneous nature of positive affect has been posited to explain the seemingly mixed findings regarding the developmental role of positive affect. Specifically, high-intensity positive affect that involves strong approach behavior and low-intensity positive affect involving pleasant emotional tone or contentment may each be associated with different developmental outcomes. Indeed, Kochanska and colleagues (Kochanska, Aksan, Penney, & Doobay, 2007) found that high-intensity positive affect was associated with lowered self-regulatory abilities, whereas low-intensity positive affect was associated with greater self-regulatory abilities. A global measure of positive reactivity (temperamental pleasure) was employed in the current study; therefore, associations between specific intensities of positive affect and social skills/academic competence may not have been detected. Future work needs to consider varying intensities/types of positive emotion, including the context in which the positive emotion is expressed given that differing contexts are more likely to elicit varying intensities of positive affect; consideration of these factors may explain the mixed findings regarding positive reactivity and children's adjustment across a variety of realms.

In addition, most of the existing work has considered a broad measure of social competence, whereas in the current study we examined children's social skills, specifically. It is widely accepted that there are additional levels of social competence, such as friendships and peer acceptance, which are shown to have distinct associations with adaptive emotional functioning (Blair, Perry, O'Brien, Calkins, Keane, & Shanahan 2015). Indeed, it is possible that toddler positive reactivity would be associated with other forms of social competence, such as peer acceptance, in early childhood and should also be investigated in future work. Moreover, it is possible that during early childhood, sophisticated social skills are not a requirement for building friendships. If so, friendships may also serve to dampen some of the stress associated with academic challenges, or provide a support system for children to draw on when attempting to meet academic demands, thereby increasing academic competence.

The second aim of the current study was to assess whether children's social skills in childhood predicted academic competence in preadolescence, as rated by both children and their teachers. As expected, children's social skills, as rated by their 1st grade teachers, was associated with greater academic performance and lowered school problems, per both the child and 5th grade teacher's report. These findings corroborate a large body of literature highlighting the importance of children's social functioning as influencing their academic adjustment. Indeed, positive associations have been found between children's academic competence and prosocial behavior and peer acceptance/social competence (e.g., Ladd, 2003; Welsh, Parke, Widaman, & O'Neil, 2001). These findings are intuitive; children who are socially skilled and therefore more likely to be accepted by their peers, likely are more involved in the classroom, therefore acquiring greater opportunities for learning. In contrast, children who are rejected by their peers are at greater risk for withdrawing from the classroom (Wentzel et al., 2009).

Of note, this association was consistent across multiple areas of children's academic functioning. Specifically, both child- and teacher-reported school problems, as indexed by children's learning and attention problems, as well as the broad array of academic functioning assessed through the teacher report of academic performance, was associated in the expected direction with children's previous social skills. These findings highlight how pervasive the early impact of children's social functioning can be, at least within the academic and school environment. Future work should consider other aspects of children's social competence, such as friendships and peer acceptance, to assess if this association holds.

Finally, as hypothesized, toddler anger reactivity at age 2 was associated with lower social skills at age 7, and lower social skills at age 7 was associated with both teacher and child report of lowered academic competence at age 10. All three indirect paths were significant, suggesting that this association exists across multiple levels of academic functioning and as rated by both the child him/herself, as well as the child's teacher. However, against expectations, there was not a significant indirect effect of positive reactivity to academic competence through children's social skills.

The results of this study suggest that temperamental anger reactivity might be particularly salient in children's pathways towards academic competence and that one pathway by which anger-prone toddlers are at risk for academic challenges is through fewer opportunities to develop and practice appropriate social skills. These reduced opportunities to refine and practice one's social skills, in turn, may negatively influence various aspects of children's experiences in the school environment, thus lowering their academic competencies. These findings are notable and greatly add to the existing literature explaining possible processes and mechanisms by which children's temperament early in development is associated with later academic functioning. This study provides initial evidence for the importance of considering social abilities as a mechanism that explains the negative association between temperamental anger and academic competence. However, many questions remain and future work should consider how and why children's social skills in childhood are especially critical for anger-prone children in promoting academic adjustment. More specifically, there are likely differing developmental pathways by which children high in temperamental anger

have lowered academic competence, not just through social abilities; as such, additional work is warranted to examine additional process mechanisms, such as through previous academic skills, cognitive abilities, and/or behavior problems.

Limitations and Future Directions

Despite the many strengths of this study, it is not without limitations. First, only parent report of temperamental anger and positive reactivity was considered. Although using a parent-reported measure gave a more general indication of children's reactivity across a broad range of contexts and situations, parental report is not unbiased (see Kagan & Fox, 2006). Certain parent characteristics such as depression or personality may influence parent's perceptions of their child (e.g., Hayden, Durbin, Klein, & Olino, 2010; Leerkes & Crockenberg, 2003). Future work should also consider behavioral and physiological measures of anger and positive reactivity. Assessing physiological arousal that is elicited in emotionally-induced settings can provide important insight into reactivity that cannot be observed by parents or in a laboratory (e.g., Calkins, 2011; Porges, 2007). For instance, it is often assumed that arousal associated with anger results in behavior that is aggressive, loud, or socially inappropriate. However, high anger reactivity does not manifest itself in that way in all children. There may be children who demonstrate high levels of physiological arousal in anger-inducing situations but show socially withdrawn behaviors (Graziano & Derefinko, 2013). It is unclear whether these behaviors have effects that are similar to those of the more overt behaviors on social and academic competencies. Moreover, as previously discussed, a general measure of temperamental pleasure was employed in the current study as the measure of positive reactivity. It is possible that there are differing pathways for children prone to experience high-intensity, approach-based positivity as opposed to those who are prone to experience low-intensity positive reactivity. This is an important arena for future empirical investigations.

In addition, we did not include a measure of parenting in the current study. Certain parenting behaviors may facilitate or undermine the development of social skills for children high in anger reactivity. For example, sensitive parenting behaviors that help children identify their anger and strategize ways that they can deal with that anger, may facilitate greater social skills for emotionally reactive children (Calkins & Perry, 2016; Sroufe, 1996). That is, sensitive and supportive parenting may lessen the negative effect of high anger reactivity on social skills and subsequent academic competence because it provides children with tools they can use to be successful when acting independently. In contrast, over-controlling or intrusive parenting that limits children's autonomy and opportunities for learning the skills necessary to manage their anger may exacerbate the association between early anger reactivity and subsequent social and academic adjustment (Fox & Calkins, 2003; Bates, Pettit, Dodge, & Ridge, 1998). Future work considering these associations is necessary.

Conclusion

This study makes an important contribution to the literature by demonstrating that early anger reactivity is associated with fewer social skills in early childhood. Moreover, deficits in social skills by childhood have significant implications for academic competence in

preadolescence. This work provides support for early entry points in teaching toddlers, especially those high in anger reactivity, to regulate their anger and engage in socially appropriate interactions with classmates and teachers. By intervening early in development, parents and clinicians can provide children with the support and resources that they need to succeed socially, which is likely to lessen subsequent academic difficulty. Thus, the current study has important intervention and prevention implications, as well as providing insight into the mechanisms that explain the association between early temperament and later academic functioning that significantly add to the existing literature.

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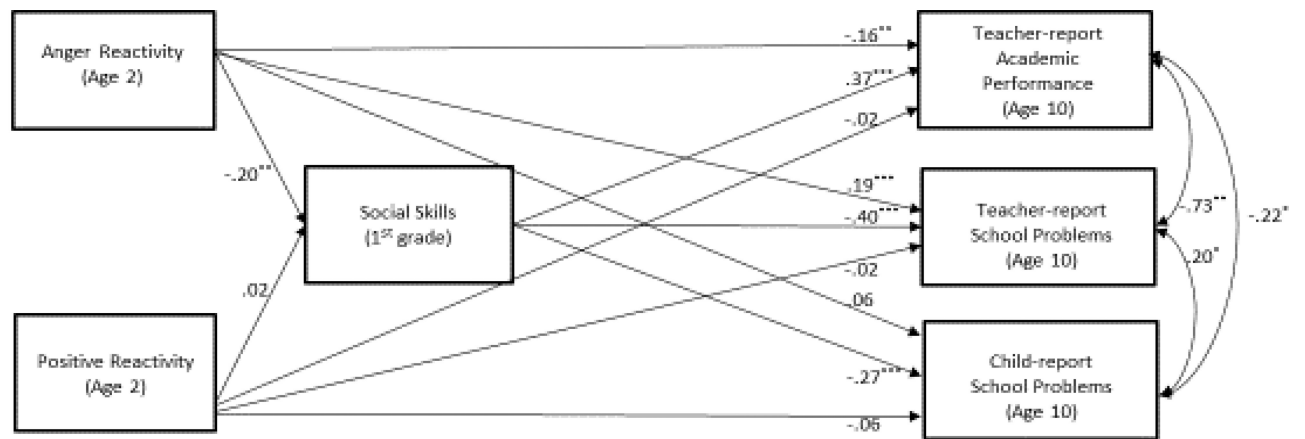
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Model Fit: $\chi^2 (27, N = 406) = 408.73, p = .00, CFI = .99, RMSEA = .02 [CI = .01, .07]$

Figure 1.

Standardized Estimates and Model Fit

Note: Child sex and race were used as covariates but are not depicted here. Significance values: $* = p < .05$; $** = p < .01$; $*** = p < .001$

Table 1

Descriptive Statistics and Correlations among Model Variables

	1	2	3	4	5	6	7	8
1. Anger reactivity age 2	--							
2. Positive reactivity age 2	.01	--						
3. Social skills age 7	-.22**	.03	--					
4. Academic competence (TR) age 10	-.21***	-.02	.37***	--				
5. School problems (CR) age 10	.11	-.05	-.34***	-.29***	--			
6. School problems (TR) age 10	.25***	-.03	-.45***	-.67***	.31***	--		
Mean	3.96	5.43	1.39	3.90	50.87	47.83		
Minimum	1.65	2.79	0.33	1.11	38.00	37.00		
Maximum	6.43	6.84	1.93	5.00	90.00	73.00		
Standard Deviation	0.88	0.64	0.31	0.89	11.39	8.91		
N	347	347	220	277	271	287		

*
 $p < .05$,**
 $p < .001$;

CR = child self-report, TR = teacher report

Table 2

Unstandardized Estimates of Indirect Effects, Standard Errors, and 95% Bias-Corrected Bootstrap Confidence Intervals

	Estimate	SE	Confidence Intervals	
			Lower	Upper
Ang(2y) → SS(7y) → T Academic Performance(10y)	-.07	.03	-.14	-.02
Ang(2y) → SS(7y) → C School Problems(10y)	1.22	.65	.27	2.88
Ang(2y) → SS(7y) → T School Problems(10y)	.81	.31	.25	1.48

Note: Ang = Parent-reported Anger; SS = Teacher-reported Social Skills; C = Child Report; T = Teacher Report